B.S c. CHEMISTRY CBCS PATTERN IN SEMESTER SYSTEM

DEPARTMENT OF CHEMISTRY
KAKATIYA UNIVERSITY WARANGAL – 506 009

Department of Chemistry, Kakatiya University introduces semester wise Choice Based Credit System (CBCS) at UG level (3 Year course) chemistry as core subject along with Discipline Specific Electives (DSE) in constituent and affiliated colleges of Kakatiya University for the students admitted in first year from 2016-17 academic year onwards.

Scheme for CBCS, work-load for each paper, distribution of marks and number of credits and scheme of examination are attached herewith along with model papers.

Internal Assessment examination will be conducted twice in every Semester. Marks will be awarded from the average of the two Internal Assessment Exams in each Semester.

The main examination (theory and practical) will be conducted at the end of semester.

All the theory papers and practical papers for I, II, III and IV semesters are common to all students. But, one elective (DSE) to be chosen by the student from the available options in V and VI Semesters.

The syllabi of theory and practical papers of I, II, III and IV semesters are enclosed. The syllabi of V and VI semesters will be kept available in the next academic year.

– Prof. Gade Dayakar
Chairperson
Board of Studies in Chemistry

Choice Based Credit System in B.Sc. Chemistry from 2016-17

Semester	Title	Course type	Hrs/ week	No. of Credits	Main exam	Internal exam	Total
I	Chemistry-I (T)	DSC-1	4	4	80	20	100
	Chemistry -I (P)	DSC-1A	2	2	50	-----	50
II	Chemistry-II (T)	DSC-1I	4	4	80	20	100
	Chemistry -II (P)	DSC-1IA	2	2	50	-----	50
III	Chemistry-III (T)	DSC- III	4	4	80	20	100
	Chemistry-III (P)	DSC-II1A	2	2	50	-----	50
IV	Chemistry-IV (T)	DSC-1V	4	4	80	20	100
	Chemistry-IV (P)	DSC-IVA	2	2	50	-----	50
V	Chemistry-V (T)	DSC-V	3	3	60	15	75
	Chemistry –V (P)	DSC-VA	2	1	25	---	25
	Elective-I (T) A/B/C	DSE-I (T)	3	3	60	15	75
	Elective -I (P)	DSE-I (P)	2	1	25	--	25
VI	Chemistry-VI (T)	DSC-VI	3/3/3	3	60	15	75
	Chemistry -VI (P)	DSC-VI A	2/2/2	1	25	----	25
	Elective –II (T) A/B/C	DSE-II (T)	3/3/3	3	60	15	75
	Elective –II (P)	DSE-II (P)	2/2/2	1	25	-	25
Total			64	40			1000

(T) = Theory; (P) = practical; DSC = Discipline specific course (Core subject); DSE = Discipline Specific Elective (Elective from core Discipline)

B. Sc I yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER I
Paper – I
Chemistry - I

Unit-I (Inorganic Chemistry) 15h (1 hr/week)

S1-I-1. s-block elements:

General Characteristics of groups I and II elements, Diagonal relationship between Li and Mg, Be and Al 2 h

S1-I-2. p-block elements 1: 7 h

Group–13: Synthesis and structure of diborane and higher Boranes (B_4H_{10} and B_5H_9), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3

Group – 14: Carbides-Classification – ionic, covalent, interstitial – synthesis. Structures and reactivity. Industrial application. Silicones – Preapartion – a) direct silicon process b) use of Grignard reagent c) aromatic silylation. Classification – straight chain, cyclic and cross-linked.

Group – 15: Nitrides – Classification – ionic, covalent and interstitial. Reactivity – hydrolysis. Preparation and reactions of hydrazine, hydroxyl amine, phosphazenes.

S1-I-3. General Principles of Inorganic qualitative analysis 6 h

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions-CO_3^{2-}, Cl^-, Br^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, CH_3COO^-, NO_3^-.

Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations (Hg_2^{2+}, Ag+, Pb+) with flow chart and chemical equations. Principle involved in separation of group II & IV cations.

General discussion for the separation and identification of group II (Hg^{2+}, Pb^{2+}, Bi^{3+}, Cd^{2+}, Sb^{2+}), III (Al^{3+}, Fe^{3+}), IV ((Mn^{2+}, Zn^{2+}) individual cations with flow chart and chemical equations. Application of concept of hydrolysis in group V cation analysis. General discussion for the separation and identification of group V individual cations (Ba^{2+}, Sr^{2+}, Ca^{2+}) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^{2+}, NH_4^+).

Unit - II (Organic Chemistry) **15h (1 hr/week)**

S1-O-1: Structural Theory in Organic Chemistry 6 h

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

Types of organic reactions: Addition reactions- electrophilic, nucleophilic and free radical. Substitution reactions – electrophilic, nucleophilic and free radical. Elimination and Rearrangement reactions– Examples.

S1-O-2: Acyclic Hydrocarbons 6 h

Alkanes – Methods of preparation: Corey-House reaction, Wurtz reaction, from Grignard reagent, Kolbe synthesis. Chemical reactivity - inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Addition of Hydrogen – heat of hydrogenation and stability of alkenes. trans-addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Oxidation (cis – additions) – hydroxylation by $KMnO_4$, OsO_4, trans addition- peracids (via epoxidation), hydroboration, ozonolysis – location of double bond. Dienes – Types of dienes, reactions of conjugated dienes – 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diels – Alder reaction.

Alkynes – Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Acidity of terminal alkynes (formation of metal acetylides) preparation of higher alkynes, Chemical reactivity – electrophilic addition of X_2, HX, H_2O (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation)

S1-O-3: Alicyclic Hydrocarbons 3 h

Nomenclature, preapartion by Freunds method, Dickmann, heating dicarboxylic metal salts. Properties – reactivity of cyclo propane and cyclo butane by comparing with alkanes. Stability of cycloalkanes – Baeyer strain theory, Sachse and Mohr predictions and Pitzer strain theory. Conformational structures of cyclopentane, cyclohexane.

Unit-III (Physical Chemistry) 15 h (1 hr/week)

S1-P-1: Atomic structure and elementary quantum mechanics 6 h

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect, Limitations of classical mechanics, Compton effect, De Broglie's hypothesis. Heisenberg's uncertainty principle, Schrodinger's wave equation and its importance. Physical interpretation of the wave function, significance of ψ and ψ^2, a particle in a box, energy levels, wave functions and probability densities. Schrodinger wave equation for H-atom. Separation of variables, radial and angular functions (only equation), hydrogen like wave functions, quantum numbers and their importance.

S1-P-2: Gaseous State 5 h

Deviation of real gases from ideal behavior. van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO_2. The van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquifaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas.

S1-P-3: Liquid State 4 h

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only). Liquid crystals, the mesomorphic state: Classification of liquid crystals in to Smectic and Nematic, differences between liquid crystal and solid / liquid. Application of liquid crystals as LCD devices.

Unit – IV (General Chemistry) 15 h (1 hr/week)

S1-G-1 Chemical Bonding 11 h

Ionic solids- lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions, covalent nature of ionic bond, covalent bond - Common hybridization and shapes of molecules.

Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of overlapping. Concept of σ and π bonds. Criteria for orbital overlap. LCAO concept. Types of molecular orbitals- bonding, antibonding and non bonding. MOED of homonuclear diatomics - H_2, N_2, O_2 , O_2^-, O_2^{2-}, F_2 (unhybridized diagrams only) and heteronuclear diatomics CO, CN^- NO, NO^+ and HF. Bond order, stability and magnetic properties.

S1-G-2 Evaluation of analytical data 4 h

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors, propagation of errors in mathematical operations – addition, substraction, division and multiplication (with respect to determinate errors).

References:

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem.
4. Vogel's Qualitative Inorganic Analysis by Svehla
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.
8. Qualitative analysis by Welcher and Hahn.
9. Textbook of Inorganic Chemistry by R Gopalan
10. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati

Unit- II

1. Text book of organic chemistry by Morrison and Boyd.
2. Text book of organic chemistry by Graham Solomons.
3. Text book of organic chemistry by Bruice Yuranis Powla.
4. Text book of organic chemistry by Soni.
5. General Organic chemistry by Sachin Kumar Ghosh.
6. Text book of organic chemistry by C N pillai

Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry by Lewis Glasstone.

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn
4. Analytical chemistry by G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C. Sudhakar

Laboratory Course 45h (3 h / week)

Paper I Qualitative Analysis - I

I. Preparations:

1. Tetrammine copper (II) sulphate,
2. Potash alum $KAl(SO_4)_2.12H_2O$,
3. Bis (dimethylglyoximato) nickel(II)

II. Analysis of two anions (one simple and one interfering)

Scheme of examination

SEMESTER –I

Internal examination: [Best of 2 –Internal exam-I, Internal exam-II]

In each exam – No. of questions –10 Total marks–20 Duration of exam –1Hr

(Two Questions compulsory from each unit. Remaining **Two** Questions from any Unit/Units)

Main examination:

Total marks–80 Duration of exam –3Hrs

Section A- Answer all **FOUR** questions (**4x8 = 32Marks**)

– Each question consists of sub questions with Internal choice.

Q-1 from **Unit –I; Q-2** from **Unit-II; Q-3** from **Unit-III; Q-4** from **Unit-IV**

Section B- Any **TWELVE** questions from given **EIGHTEEN** questions (12x4 = 48Marks)

FOUR questions compulsory from each unit**;** remaining **TWO** from any Unit/Units

Practical examination:

Total marks–50 Duration of examination –3Hrs

Q -1: Analysis of anions

Common anion – 13 Marks

Interfering anion – 12 Marks

Q -2: Preparation – 10 Marks

Samples- 5 Marks; Viva- 5 Marks; Record- 5 Marks

Model paper

FACULTY OF SCIENCE
B.Sc I YEAR
SEMESTER-I EXAMINATION
CHEMISTRY PAPER-I

Time: 3 Hours] **[Max. Marks: 80**

SECTION - A

Answer ALL questions **(4 x 8 = 32 marks)**

1. Describe

(a) Any two preparation methods and two chemical properties of Diborane.

(b) Structure of Diborane.

OR

(c) Write the preparation and any two chemical properties of hydrazine.

(d) Write the preparation and any two chemical properties of hydroxylamine'

2. (a) Write any two methods of preparation of alkenes. Explain Diels-Alder reaction.

(b) Explain addition of HBr to unsymmetrical Alkenes with an example.

OR

(c) Explain the reactivity and orientation in electrophilic substitution reactions on phenol.

3. (a) Derive Vander Waal's equation of state.

OR

(b) Write a short note on symmetry elements in solids.

4. (a) What are conformational and configurational isomers? Write at least one example to each.

(b) Define common ion effect and its applications in salt analysis.

OR

(c) Describe the methods for racemic resolution.

(d) Write the characteristic reactions of I group anions.

SECTION – B

Answer any twelve of the following questions (12 x 4 = 48 marks)

1. Explain the diagonal relationship between Li & Mg, Be & Al.

2. Describe the synthesis and structure of Borazole.

3. Explain the general physical characteristics of groups I & II elements.

4. Write preparation and applications of silicones.

5. Define inductive effect. Explain any two of its applications.

6. Compare the acidity of carboxylic acids and phenols and write the suitable reason for your answer.

7. Write the mechanism for free radical substitution reaction with mechanism with suitable example.

8. Write the ozonolysis of propene with mechanism.

9. Write reactions of acetylene with following reagents.

(a) $KMnO_4$ (b) OsO_4

10. Write a short note on crystal-defects.

11. Describe the liquefaction of gas by Linde's method.

12. Define liquid crystals and write its applications.

13. Define the terms enantiomers and diastereomers and write one example to each.

14. Define solubility product and write it's equation for CaF_2.

15. What are interfering anions and write the examples.

16. Write E, Z- forms of 3-methylhex-3-ene.

17. How do you prepare n-butane using Kolbe's electrolysis.

18. Describe the structure of boran nitride.

Model paper

FACULTY OF SCIENCE
B.Sc-I YEAR SEMESTER-I
PRACTICAL EXAMINATION
CHEMISTRY P A P E R -I

Time: 3 Hours] **[Max. Marks: 50**

Q -1: Analyze one common anion and one interfering anion present in a given mixture. (2x10M)

Q -2: Prepare a pure sample of ferrous ammonium sulphate . (15 M)

Q -3*: Write very short answers for the following questions. (5x1=5M)

1. What are the ions separated by using acidified silver nitrate solution?
2. Which anion is identified by using neutral ferric chloride solution?
3. What are the anions present in the soluble group?
4. Write any two interfering anions.
5. Why lime water turns milky on passing CO_2 gas? Give the corresponding chemical equation.

Samples- 5 Marks; Record- 5 Marks

* (from question bank supplied by Department of Chemistry, Kakatiya University)

Model paper

B.Sc I YEAR SEMESTER-I

CHEMISTRY

Internal assessment

Time: 90 min Max. Marks: 20

Answer all the following questions (10 x 2 = 20 marks)

1. Describe the structure of diborane.
2. Write the applications of silanes.
3. Write the reactions for 1,2 and 1,4 addition of HBr to 1,3 – butadiene.
4. Why phenols are more acidic than alcohols.
5. Write any two examples for elecrophilic substitution reactions.
6. What is Joule Thomson effect?
7. Define extrinsic and intrinsic semiconductors.
8. Write the examples for asymmetric and disymmetric molecules.
9. Define mesoform and write the suitable example.
10. Write the group reagents for identification of I and II group cations.